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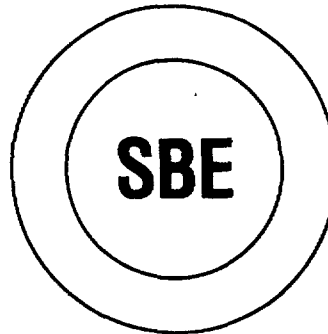
FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

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**Comments of the  
Society of Broadcast Engineers, Inc.**

RM No. 9147

Amendment of Parts 2 and 25  
to Permit NGSO FSS Operations  
Co-Channel with GSO and  
Terrestrial Systems in the 12, 13,  
14, and 17 GHz Bands  
(SkyBridge L.L.C. Proposal)



October 8, 1997

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**SOCIETY OF BROADCAST ENGINEERS, INC.**  
Indianapolis, Indiana

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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
)  
Amendment of Sections 2.106 and 25.202 )  
of the Commission's Rules to Permit )  
Operation of NGSO FSS Systems )  
Co-Frequency with GSO and Terrestrial )  
Systems in the 10.7-12.7 GHz, )  
12.75-13.25 GHz, 13.75-14.5 GHz, )  
and 17.3-17.8 GHz Bands, and to )  
Establish Technical Rules Governing )  
NGO FSS Operations in these bands )

RM No. 9147  
SkyBridge L.L.C.

To: The Commission

**Comments of the Society of Broadcast Engineers, Inc.**

The Society of Broadcast Engineers, Incorporated ("SBE"), the national association of broadcast engineers and technical communications professionals, with more than 5,000 members in the United States, hereby respectfully submits its comments in the above-captioned Petition for Rule Making proposed by SkyBridge L.L.C.

**I. SkyBridge Petition for Rule Making and Application**

1. On July 3, 1997, SkyBridge L.L.C. ("SkyBridge") filed a Petition for Rule Making ("SkyBridge Petition") proposing to allow use of certain frequencies for Earth-to-Space and Space-to-Earth transmissions in support of a proposed system of 64 non-geostationary orbit ("NGSO") low Earth orbit satellites, capable of providing a wide range of data, voice, and video broadband services. This SkyBridge Petition supplements the February 28, 1997, SkyBridge application for authority to build, launch, and operate its proposed system of low Earth orbit satellites.<sup>1</sup>

2. All of one of the proposed SkyBridge frequency bands, 12.75-13.25 GHz, is currently allocated in the United States to TV Broadcast Auxiliary and to Cable Television Relay

<sup>1</sup> According to Footnote 12 of the SkyBridge Petition, on July 3, 1997, SkyBridge also filed a "minor-change amendment" to its February 28, 1997, application, deleting the 14.5-14.8 GHz and 17.8-18.1 GHz bands, which "are used by U.S. Government systems." SBE has been unable to obtain a copy of this amendment, being advised by Commission staff that they are unable to locate the document. However, based on SkyBridge's own description of its Amendment, SBE concludes that SkyBridge did not change the proposed use of 10.7-12.75 GHz for service downlinks, and 12.75-13.25 GHz for service uplinks. These are the frequency bands of interest to SBE.

## **SBE Comments: SkyBridge Petition and Application**

Service ("CARS") terrestrial microwave stations, both for fixed, point-to-point service, and also for Temporary Fixed and Mobile service.<sup>2</sup> Because the SkyBridge Petition, and the related SkyBridge application for low Earth orbit satellites, Gateway Stations, and User Terminals propose sharing of 13 GHz TV Broadcast Auxiliary (and CARS) frequencies by User Terminals without, in SBE's opinion, adequate safeguards, SBE opposes both the SkyBridge Petition and the SkyBridge application, and urges that the multiple waivers requested in the SkyBridge application not be granted.

3. The SkyBridge system would use "Gateway Stations" to transmit between its proposed constellation of 62 low Earth orbit satellites. These satellites would be in circular orbits, but, because their elevation would be only 1,457 km instead of the approximately 42,000-km height of geostationary satellites, the satellites would transition across the sky as seen from any particular terrestrial vantage point. Thus, a "constellation" or many satellites is necessary to provide continuous service. According to the SkyBridge application, each satellite would generate a up to 45 steerable Space-to-Earth spot-beams, each illuminating a 350-km radius "Gateway Cell" with a Gateway Station at its center. Each satellite spot-beam would remain fixed with respect to the ground as the satellite moves, with hand-offs from one satellite to another at the appropriate times. User Terminals would operate within these Gateway Cells, and would communicate with a currently available low Earth orbit satellite, and that satellite would then relay those transmissions to the nearest Gateway station. Finally, the Gateway station would either connect to the appropriate switched narrow band or broadband hard-wired terrestrial network, or, for Gateway Stations in remote areas, would use "Infrastructure Link" frequencies that would allow a remote Gateway Station to first relay its signal to an available satellite, which would in turn relay the signal to a Gateway Station with access to terrestrial servers and networks.

4. According to Table 1, Page 8, of the SkyBridge Petition, in concert with Figure IV-2, Page 21, of the SkyBridge application, Service Uplinks would use 12.75–13.25 GHz for transmissions from portable User Terminals to the closest available and visible low Earth orbit satellite, and would use 10.7–12.75 GHz for transmissions from the low Earth orbit satellite to terrestrial User Terminal. Although this choice of 12.75 GHz for the transition frequency between downlink and uplink frequencies means that both the satellites and User

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<sup>2</sup> Footnote 15 at Page 11 of the SkyBridge Petition claims that the [Television] Broadcast Auxiliary service operates from 10.7–11.7 GHz. This is incorrect. the 13 GHz TV Broadcast Auxiliary band is from 12.70–13.25 GHz, the same as for CARS. It is indeed troubling that the SkyBridge Petition cannot even properly identify the frequency bands of other services that it claims to be able to co-exist with and to protect.

## SBE Comments: SkyBridge Petition and Application

Terminals would be co-channel to 12.70–13.25 GHz terrestrial TV Broadcast Auxiliary operations, the fact that the Space-to-Earth downlink transmissions would meet the power flux density limits of Section 25.208(b) of the FCC Rules "at all times<sup>3</sup>," means that the downlink portion, which would only overlap the first 50 kHz of the 12.70–13.25 GHz TV Broadcast Auxiliary band to start with, is unlikely to cause interference to terrestrial TV Broadcast Auxiliary Service ("BAS") stations (although the reverse might not be true if, due to pressures placed on the 2 and 2.5 GHz TV BAS band, where mobile stations on race cars, toboggans, *etc.* often transmit straight up to a relaying station on a blimp or helicopter, are forced to expand such operations to 13 GHz TV BAS frequencies). However, the same conclusion cannot be reached for User Terminal Earth-to-Space uplink transmissions.

5. According to Table IV-12, Page 60, of the SkyBridge application, User Terminals would use antennas between 0.5 and 0.6 meters in size and would have equivalent isotropic radiated powers ("EIRP") between 64.5 and 73.8 dBm. These User Terminal antennas would either be "active antennas" (apparently steered electronically) or mechanically steered, in order to keep the antenna aimed at the low Earth orbit satellite in question.

6. By comparison, a 13 GHz TV Broadcast Auxiliary point-to-point fixed microwave station would typically use a transmitter power of 0.5 to 1 watt, and would have an EIRP between perhaps 60 and 70 dBm, after allowing for typical waveguide losses. Typical Temporary Fixed 13 GHz TV Broadcast Auxiliary stations would also have transmitter powers of 0.5 to 1 watt, but would usually employ much lower gain transmitting antennas, resulting in EIRPs of 40 to 50 dBm. Mobile 13 GHz TV Broadcast Auxiliary stations, or TV Pickups, would typically have transmitter powers of 100 to 500 mW and antenna gains of 0 to 10 dBi, for EIRPs of between 20 and 30 dBm.

7. According to Section V.A.2, Page 74, of the SkyBridge application, protection of co-channel terrestrial 13 GHz TV BAS stations would be predicated on prohibiting the use of User Terminal uplink transmissions when the elevation angle of the steered uplink antenna falls below 10° above the horizontal. However, the SkyBridge application then goes on to concede:

It is possible, however, that User Terminals may be located in sites that are undesirable from the standpoint of terrestrial operations. For this reason, each Gateway's software will contain a map of the terrestrial infrastructures in its Gateway Cell. A User Terminal located near a terrestrial facility will be permitted

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<sup>3</sup> SkyBridge application at Section V.A.2, Page 74.

## SBE Comments: SkyBridge Petition and Application

to transmit (pursuant to a command issued via Satellite by the Gateway serving the User Terminal) only at specific frequency bands not used by subject terrestrial stations. Alternatively, or additionally, depending on the circumstances, the Gateway may instruct the User Terminal to restrict its azimuth and/or elevation angle to avoid terrestrial receivers.

Because the bands sought by SkyBridge are only lightly used by terrestrial operators in the United States, SkyBridge does not expect accommodation of such users to adversely affect the capacity of the SkyBridge System.

8. First, the 12.70–13.25 GHz TV BAS band is not "lightly used;" to the contrary, it is already heavily used by TV stations, TV network entities, cable television systems, and cable television network entities. Again because of pressures being placed on the 2 and 2.5 GHz TV BAS bands by PCS, MSS, and Congress, and the need for additional studio-to-transmitter ("STL") links for digital television ("DTV") stations, loading of the 13 GHz TV BAS band can only be expected to increase.

9. Second, SBE believes that it would be unrealistic, and naive, of the Commission to expect that a newcomer user trying to launch a new service would give priority to identifying all fixed 13 GHz TV BAS and CARS links within 350 km of each and every Gateway Station, and then to properly program those Gateway Stations to in turn instruct User Terminals not to transmit on a particular frequency or in a particular direction. Further, there would be no easy way for 13 GHz BAS or CARS licensees to check for the proper programming of newcomer User Terminals, which could eventually become ubiquitous. Even if SkyBridge did accomplish such protective programming, would it update its programming to protect new 13 GHz BAS links, or does SkyBridge plan to only protect links in existence at time a Gateway Station is commissioned? If SkyBridge is not proposing an ongoing updating process, then it in effect is proposing a "freeze" of the 13 GHz BAS band and *de facto* re-allocation to satellite services.

10. And even if SkyBridge, or any other entity attempting to launch a new system, really did take the assurances in its application regarding interference protection protocols to heart, even though this would undoubtedly mean allocating less resources to expansion of its core business and less accommodation of new customers, this approach is useless for Temporary Fixed and Mobile 13 GHz TV BAS stations because, by definition, their locations are a moving target. Thus, while there is theoretically hope of protecting fixed 13 GHz TV BAS links, there is no hope of using the proposed SkyBridge mitigation measures for Temporary Fixed and Mobile 13 GHz TV BAS operations.

## **SBE Comments: SkyBridge Petition and Application**

11. Especially for Temporary Fixed and Mobile 13 GHz TV BAS receivers, which may be located at high elevations in order to be able to receive feeds from Temporary Fixed or Mobile transmitters covering a nearby event, the SkyBridge presumption of no interference from User Terminals using antenna elevation angles of 10° or greater is a poor one, as even User Terminal antennas with such elevation angles may directly illuminate with its main beam a 13 GHz TV BAS receiver.

12. Given the high EIRPs of the SkyBridge User Terminals, and the proposed co-channel frequency re-use, serious interference to 13 GHz TV BAS operations would be expected, and for that reason SBE opposes the SkyBridge Petition and the SkyBridge application, and requests that the Commission treat these comments also as an Informal Objection to the SkyBridge application.

## SBE Comments: SkyBridge Petition and Application

### Summary

13. SBE is not persuaded that terrestrial User Terminal uplinks can share the 12.70-13.25 GHz TV Broadcast Auxiliary Service spectrum and not cause harmful interference to those stations. SBE is skeptical of the complex preclusion programming measures that would be required of User Terminals, and whether SkyBridge would invest the manpower to program User Terminals to protect all fixed 13 GHz TV BAS links within 350 km. Even if this were to be faithfully done, these mitigation measures would be useless for Temporary Fixed and Mobile 13 GHz TV BAS operations.

Respectfully submitted,

Society of Broadcast Engineers, Inc.

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